Space Weather Technical Forecast

Issued on Saturday, 14 May 2022 at 13:01 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1-R2 radio blackouts likely. Slight chance (20%) of G1/Minor geomagnetic storm on day 3 (16th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with frequent mostly low level C-class flares, mainly from AR3007 and AR3011.

There are currently five numbered sunspot regions on the visible disc. The largest and most complex region remains AR3007 (Eki/Beta), now centre disc in the southern hemisphere. No delta configuration is currently observed in this region, however. Both AR3006 (Bxo/Beta) in the southwest, and AR3008 (Axx/Alpha) north central disc, have shown decay. AR3010 (Eao/Beta) in the far southeast has shown little overall change. AR3011, near the northeast limb, is still a simple Cro/Beta. A new un-numbered region also close to the northeast limb (Cro/Beta) continues to emerge into better view. Another new un-numbered region in the southeast quadrant remains a simple Bxo/Beta type.

No Earth directed coronal mass ejections (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed as measured by ACE & DSCOVR at L1 has been at ambient levels, between 320-360 km/s. Density was mostly average, but trended slightly upwards in recent hours with a peak of 17 ppcc. The total interplanetary magnetic field strength (IMF), Bt, showed a similar trend, with a recent peak of 12 nT. Its north-south component, Bz, was mostly negative, peak -7nT until around 14/0500 UTC, then became mainly positive, peak +11 nT. The Phi angle was predominantly positive (away from the Sun). Resultant geomagnetic activity was largely Quiet, with one Unsettled period observed at 13/2100-2400 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has remained at largely background levels, while the corresponding electron fluence well below the Active (1e8 integrated pfu) threshold, with a very slight rising trend. Observed fluence at 14/0000 UTC was 1.03e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low, with a chance of M-class flares, and a slight chance of an X-class flare. The flare risk may trend a little higher through the period.

Solar Wind / Geomagnetic Activity: Solar winds are expected to remain slow-ambient initially, along with a largely Quiet geomagnetic activity. However a coronal hole high speed stream is expected to connect with the Earth on day 3 (16th), with winds becoming elevated on days 3 and 4. This may enhance geomagnetic activity with Unsettled to Active periods on days 3 & 4 (16th and 17th), with a chance of a G1/Minor Storm at the onset of the high speed stream (day 3 -

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16th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during this period, although there is slight risk of an S1 or greater event, mainly due to AR3007 as it transits west from a central location. The high energy electron flux (greater than 2 MeV) is forecast to remain at background to moderate levels through much of the forecast period, but perhaps an increased chance of the diurnal peak reaching high levels by day 4 (17th). The 24-hour electron fluence is expected to remain below, or well below, the Active (1e8 integrated pfu) threshold during the forecast period, but with a probable rising trend late in the period.

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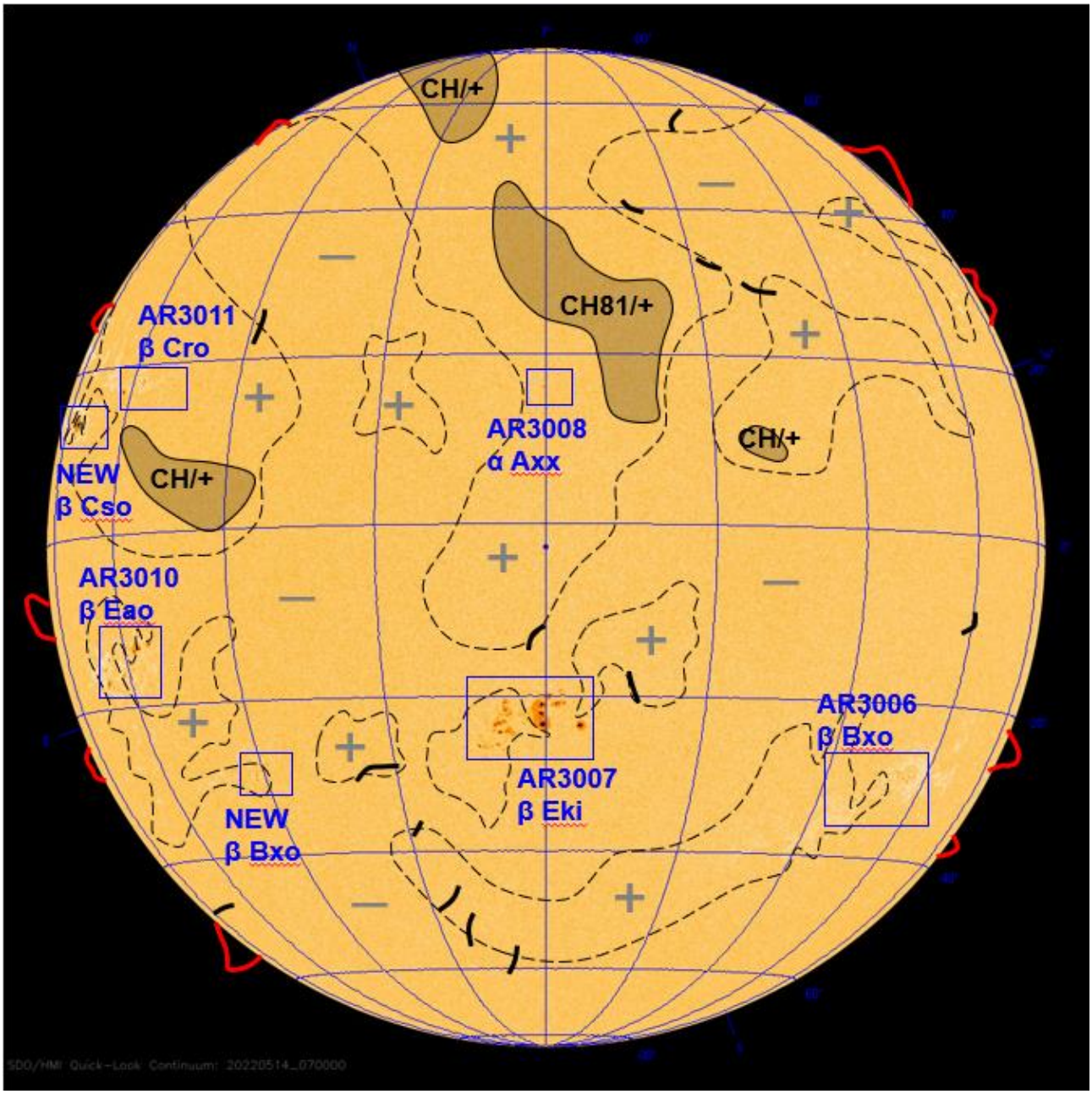
Figure 1. Solar Analysis Valid 14/0700 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

Solar winds are expected to be slow-ambient through days 1-2 (14th and 15th), before increasing on days 3-4 (16th-17th), under the influence of the high speed stream originating from CH81/+. This feature appears more coherent and better defined this rotation. It generated solar winds up to 570 km/s previously, so similar strengths are at least likely. While geomagnetic activity is expected to be largely Quiet on days 1-2, the anticipated elevated solar winds may trigger some Unsettled and Active periods on days 3-4 (16th), with a slight chance of a G1/Minor Storm on day 3 (16th), due to the arrival of the CIR associated to CH81/+.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

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Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours, with frequent mostly low level C-class flares, mainly from AR3007 and AR3011. Further bright flux regions apparent on STEREO-A EUVI 195 imagery beyond the northeast limb, are likely to indicate returning or new active regions, which will rotate onto the visible disc over the coming days, likely enhancing the flare risk.

There are currently five numbered sunspot regions on the visible disc. The largest and most complex region remains AR3007, now centre disc in the southern hemisphere. There has been some coalescence of spots in its intermediate portion, with slight decay in some trailing spots. No delta configuration is currently observed. Both AR3006 (Bxo/Beta) and AR3008 (Axx/Alpha) have shown decay and have been re-classified. AR3010 (Eao/Beta) has shown little overall change, with some waxing/waning of trailer spots. AR3011 is still a simple Cro/Beta, showing slight recent decay. A new un-numbered region close to the northeast limb (Cro/Beta) continues to emerge into better view. Another new un-numbered region in the southeast quadrant remains a simple Bxo/Beta type.

Solar activity is expected to be Low, with a chance of M-class flares, and a slight chance of an X-class flare. The flare risk may trend a little higher through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	40	50	50
Very Active	R3 to R5 X Class	No	5	5	10	10

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is close to background levels and is generally expected to remain at that level throughout the period. However, there is a slight chance of an S1 or greater event during the forecast period, primarily due to the presence of AR3006 in the southwest quarter, and AR3007 as it transits west from a central location.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is expected to be at background to moderate levels through days 1-3, but may rise on day 4 (17th) once the high speed stream originating from CH81/+ becomes established. The corresponding electron fluence is therefore expected to remain below, or well below, the Active (1e8 integrated pfu) threshold during the forecast period, but with a probable rising trend late in the period. This is reflected current REFM output.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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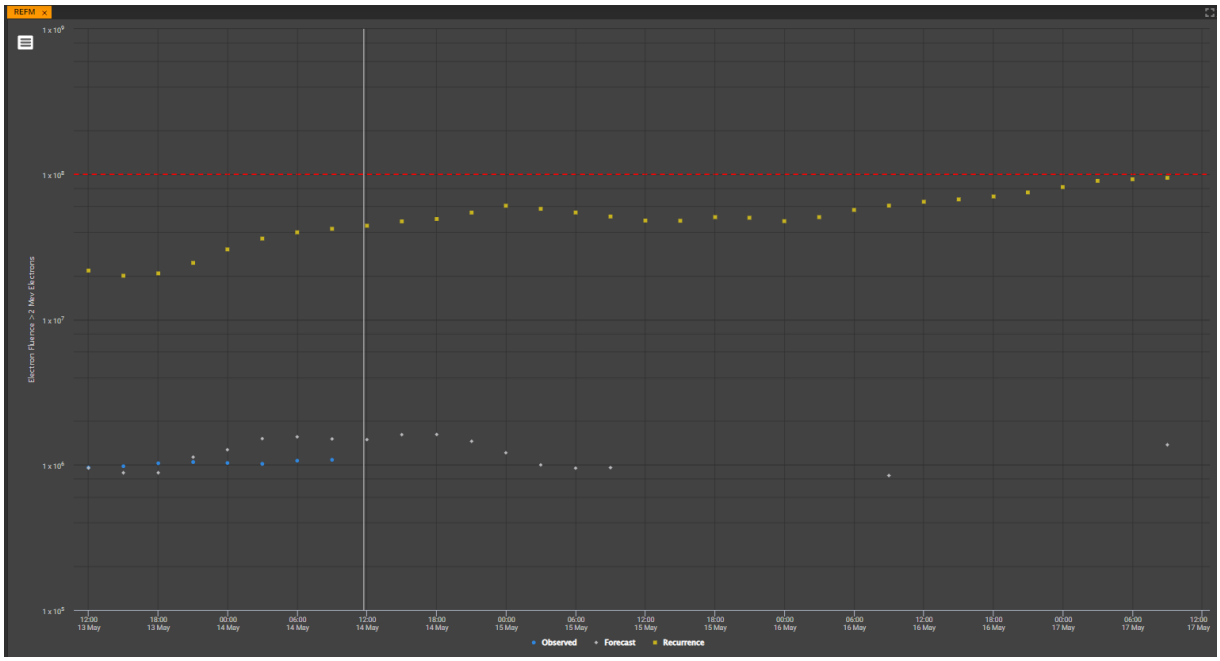
Figure 2: MOSWOC REFM output. (*Yellow data points – recurrence values* , white – *REFM forecast, blue – observed fluence)*



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